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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

STAHL, MICHAEL J

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/594,924	Applicant(s) PROVOST ET AL.	
	Examiner MICHAEL STAHL	Art Unit 2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 May 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-29 and 31-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 31 is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-13, 15-18, 20-29, 32 and 33 is/are rejected.
- 7) ☒ Claim(s) 9, 14 and 19 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-8, 20-26, 28, and 32-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Libori et al. (US 2002/0061176, cited in information disclosure statement).

Claim 1: Libori discloses an optical fiber comprising a central core **390**; a first annular region surrounding the central core; a second annular region surrounding the first annular region and comprising medium-size cavities **392** the cross sections of which remain strictly between a given first threshold and a given second threshold strictly higher than the first threshold; a third annular region surrounding the second annular region and comprising large cavities **393** the cross sections of which remain strictly above the second threshold; wherein any radius of the fiber encounters at least a medium-size cavity or a large cavity; and the average distance between the outer perimeter of the second annular region and the inner perimeter of the third annular region is less than half the average dimension of a large cavity. See fig. 39. Since claim 1 does not specify any threshold values, they may be arbitrarily defined. In this case the first threshold can be defined as the arithmetic average of the diameters of one cavity **391** and one cavity **392**. Similarly, the second threshold can be defined as the arithmetic average of the diameters of one cavity **392** and one cavity **393**.

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Claim 2: The average distance between the outer perimeter of the second annular region and the inner perimeter of the third annular region is less than a quarter of the average dimension of a large cavity.

Claim 3: The first annular region comprises small cavities **391** the cross sections of which remain strictly below the first threshold.

Claim 4: Any radius sweeping out an angular sector between two medium-size cavities **392** encounters at least one small cavity or medium-size cavity.

Claim 5: The average distance between the outer perimeter of the first annular region and the inner perimeter of the second annular region is less than half the average dimension of a medium-size cavity.

Claim 6: At least ten of the large cavities **393** in the third annular region are in the same annular layer and each has a ratio between its greatest dimension and the distance from its center to the core center that is greater than 0.3.

Claim 7: At least ten of the medium-size cavities **392** in the second annular region are in the same annular layer and angularly offset relative to the large cavities **393** in such a manner as to face the spaces between the large cavities.

Claim 8: The space between two contiguous large cavities in the third annular region is less than the wavelength at which the optical fiber is used. The fiber can be used at an arbitrary wavelength which satisfies the recited condition.

Claim 20: [0219] states that the fiber may be made with an elliptic core, in which case it would have just two axial symmetries. Since the core is defined by positions of the cavities in the first annular region, the distribution of cavities would in turn have at most two axial

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symmetries. Also note [0116] which states the core may be rectangular, and [0115] which mentions configuring the fiber with two-fold symmetry.

Claim 21: The core may be doped with a rare earth (e.g. [0111], [0113]).

Claims 22, 23, 25, 26: The fiber may be used in the recited applications (e.g. [0113], [0217]).

Claim 24: The core may be doped with germanium ([0113]).

Claim 28: An optical signal amplifier is a regenerator device.

Claim 32: There are 12 large cavities **393** in the same annular layer in the third annular region.

Claim 33: There are 12 medium-size cavities **392** in the same annular layer in the second annular region.

Claims 1-4, 8, 10-13, and 15-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Saitoh et al. (Optics Express article cited in information disclosure statement).

Claim 1: Saitoh discloses an optical fiber comprising a central core; a first annular region surrounding the central core; a second annular region surrounding the first annular region and comprising medium-size cavities (diameter d_3) cross sections of which remain strictly between a given first threshold and a given second threshold strictly higher than the first threshold; a third annular region surrounding the second annular region and comprising large cavities (diameter d_4) the cross sections of which remain strictly above the second threshold; wherein any radius of the fiber encounters at least a medium-size cavity or a large cavity; and the average distance between the outer perimeter of the second annular region and the inner perimeter of the third annular

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region is less than half the average dimension of a large cavity. See fig. 5(a). Since claim 1 does not specify any threshold values, they may be arbitrarily defined. In this case the first threshold can be defined for example as $(d_3 + d_2)/2$. Similarly, the second threshold can be defined as $(d_3 + d_4)/2$. Using the values for fig. 5(a), the *maximum* distance between the outer perimeter of the second annular region and the inner perimeter of the third annular region is 0.19Λ (this occurs at the corners of the respective hexagons), which is less than half d_4 , i.e. less than 0.475Λ . The average distance is less than the maximum distance.

Claim 2: The average distance between the outer perimeter of the second annular region and the inner perimeter of the third annular region is less than a quarter of the average dimension of a large cavity ($0.19\Lambda < 0.2375\Lambda$ using the values above).

Claim 3: The first annular region comprises small cavities (diameter d_1) the cross sections of which remain strictly below the first threshold.

Claim 4: Any radius sweeping out an angular sector between two medium-size cavities encounters at least one small cavity or medium-size cavity.

Claim 8: The space between two contiguous large cavities in the third annular region is less than the wavelength at which the optical fiber is used. The space is $0.05 * 1.56$ microns, which is less than the operating wavelength of about 1.55 microns.

Claims 10-12: The greatest dimension of the structure of the fiber in fig. 5(a) is $8.95 * 1.56$ microns or about 14 microns.

Claim 13: The cavities in the first annular region are disposed in such a manner that the effective area of the optical fiber is less than $10 \mu\text{m}^2$ (fig. 6(c)).

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Claims 15-18: The cavities in the first annular region are disposed in such a manner that the absolute value of the chromatic dispersion of the optical fiber remains less than 1 ps/nm/km from 1500-1625 nm (fig. 6(a)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 27 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Libori et al. (cited above).

Libori does not specifically disclose the recited generic optical devices. The reference was directed to details of the inventive fibers rather than enumerating and describing in detail every possible application of the inventive fibers via substitution for fibers in devices which were already known. A person of ordinary skill in the art at the time the invention was made would

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have found it obvious to use the Libori fibers in any device which could benefit from the disclosed properties. Since the recited devices were already well known there would be nothing unpredictable about using the Libori fibers therein.

Response to Arguments

Libori

The remarks argued that Libori does not disclose first or second thresholds of claim 1. There is no particular definition of the thresholds in claim 1, so an arbitrary definition can be used and the rejection was modified to demonstrate an example of this. In general, it appears that the purpose of applicant's reference to thresholds is to permit cavities designated as "medium-size" to vary in dimension so long as they do not become as large as "large" cavities. Clearly Libori shows cavities of distinctly different sizes with no overlap between "medium" and "large" cross sections. The remarks also argued that Libori does not disclose the distance between the perimeters being less than half of the average dimension of a large cavity. However, this condition is evident from a simple inspection of fig. 39. The hexagon which circumscribes cavities **392** is almost touching if not overlapping with the hexagon inscribed in cavities **393**.

The remarks regarding dependent claims 2-6 also appeared to dispute things which are plainly evident from the figure and are thus not persuasive. Rather than just alleging that something is not disclosed, it would be potentially more persuasive if the remarks could provide elaboration or a counterexample. For example, with regard to claim 4, which (if any) angular sector between medium-size cavities in fig. 39 fails to encounter a cavity in the first or second annular region?

Regarding claim 8, the remarks argued that Libori mentions a particular wavelength range in claims 11-17. This is not persuasive because the rejection indicated that an arbitrary wavelength which satisfies the recited condition could be used. The rejection did not state that such wavelength would be optimal or preferred (nor does claim 8 require it).

Regarding claim 9, the rejection has been withdrawn. Upon further consideration of applicant's disclosure, it is apparent that any annular region which was described as "circular" had more than six cavities which were clearly not arranged on a hexagon. All the annular regions in fig. 39 of Libori have cavities arranged on a hexagon. None of them are regarded as being "circular" as the term is used by applicant.

Regarding claim 20, the remarks argued that Libori did not disclose axial symmetries of the distribution the *cavities* of the first annular region. However, since the core boundary is defined by the positions of these cavities, it follows that an elliptical core would have a different distribution from a circular core (see the revised rejection above).

Regarding claim 28, the remarks are unpersuasive since they did not explain how or why an optical signal amplifier is not an optical regenerator as asserted in the rejection.

Regarding claims 27 and 29, the remarks appeared to argue that a wavelength converter device comprising an optical fiber and an optical filter device including a saturable absorber and comprising an optical fiber are not common knowledge. Initially it is noted that claim 27 refers to a wavelength demultiplexer device, not a wavelength converter device. The remarks are not persuasive since it was well known in the art to use optical fibers to transport optical signals. It is further noted that claims 27 and 29 recite no specific structural arrangement or functional purpose for the fiber in relation to the recited devices; they merely recite such-and-such device

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comprising an optical fiber according to claim 1. Therefore, the fiber could be anywhere or do anything within that device. Using the fiber simply to transport optical signals to, from, or within the devices is sufficient to satisfy these claims, and such use was already known at the time the invention was made.

Saitoh

As to claim 1, the remarks are unpersuasive for the same reasons mentioned above with regard to Libori. The remarks also argued in terms of the hole-to-hole spacing (1.56 microns) and appeared to equate this with the distance between the outer perimeter of the second annular region and the inner perimeter of the third annular region. These are different quantities. Note that the hole-to-hole spacing is constant, while the distance between adjacent perimeters of annular regions generally decreases with increasing distance from the center of the core. Nevertheless, the rejection was revised to cite more specific values. Furthermore, the remarks referred to d_3 but the rejection interpreted cavities with d_4 as the large cavities.

The remarks regarding claims 2-4 are believed to have been addressed earlier within this Office action. However, if applicant disagrees then more specific explanatory remarks should be submitted.

The rejections of claims 6-7 and 32-33 under Saitoh are withdrawn in view of reconsideration of that reference. For example, d_4 is 0.95Λ and the smallest possible distance between the center of the fiber and the center of one of the large holes is $2*3^{0.5}\Lambda$, so their ratio is only about 0.27 and less than 0.3 as claim 6 requires.

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The rejection of claim 9 is withdrawn for the same reason explained above with regard to Libori.

Allowable Subject Matter

Claim 31 is allowed since it was rewritten in independent form (see the last Office action). Claims 9, 14, and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The applied references fail to disclose or suggest that the second and third annular regions are circular while the first annular region is hexagonal, or that the effective area of the disclosed fibers is less than $5\text{ }\mu\text{m}^2$, or that there is a zero dispersion wavelength between 1530 and 1570 nm, in combination with all the other structural features of parent claim 1.

Conclusion

Inquiries about this letter may be directed to examiner Stahl at the number below. Inquiries of a general or clerical nature (e.g., a request for a missing form or paper, etc.) should be directed to the technical support staff supervisor at 571-272-1626. Official correspondence which is eligible for submission by facsimile and which pertains to this application may be faxed to 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about

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the PAIR system, see <http://pair-direct.uspto.gov>. Questions about the Private PAIR system should be directed to the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Mike Stahl/

Examiner, Art Unit 2874

August 28, 2008